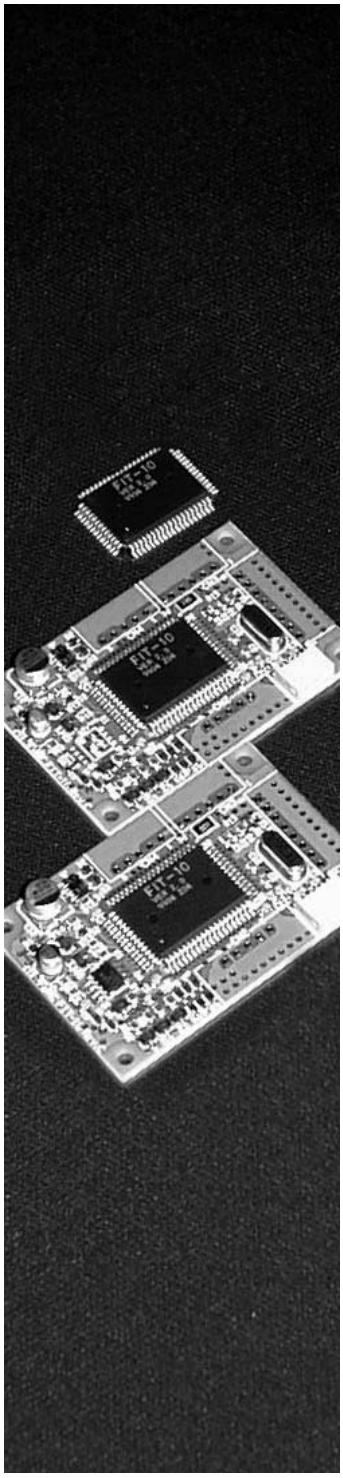

DMC Co., Ltd.
Interface with Touch

Analog Resistive Touch Screen Controller
FIT-10 Series User's Guide

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1. Product Overview

1-1. Products Applicable

This specification is applicable to FIT-10/IC, FIT-10/IF and FIT-10/IF-E.

1-2. Product Names

Product Name	Description
FIT-10/IC	Analog resistive touch screen micro-controller.
FIT-10/IF	FIT-10/IC installed touch screen controller board.
FIT-10/IF-E	FIT-10/IC installed touch screen controller board with EEPROM.

1-3. Indication

Following are referred on this specification.
FIT-10 "FIT-10" represents FIT-10/IC, FIT-10/IF and FIT-10/IF-E.

1-4. Overview

FIT-10 is a touch screen control device that performs an A/D conversion of an analog signal of a resistive touch screen, and transmits the coordinate data to the host in a 10-bit resolution serial correspondence at 9600bps. FIT-10 can be used for various applications for its functions including the power saving mode, seven sampling speed settings (max. 150p/s *1), two external switch connections, and automatic calibration data loading with an external EEPROM. *2

§ FIT-10/IC An 8-bit micro-controller for the analog resistive touch screen with a 10-bit A/D resolution. FIT-10/IC works with the peripheral circuits such as touch screen interface circuit, RS-232C interface circuit, and optional EEPROM.

§ FIT-10/IF FIT-10/IC installed analog touch screen controller board. FIT-10/IF dispenses a need to newly design the peripheral circuits, and can easily be used by connecting to the touch screen and the host. Using the driver software *3 enables the mouse emulation on various operation systems and dispenses the need to newly design the controller software.

§ FIT-10/IF-E An EEPROM installed version of FIT-10/IF. The calibration data can be stored in the EEPROM and automatically read after power-on.

*1: 150 transmissions of coordinate data per second.
*2: EEPROM can be optionally installed on the peripheral circuits of FIT-10/IC. Not applicable to FIT-10/IF.
*3: Please contact the local sales representatives for software availability.

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1-5. Features

§ Two output modes – "Coordinate Mode" transmits the raw coordinate data in 10-bit and "Calibration Mode" transmits the coordinate data that is being calibrated to the display coordinates.

§ The calibration data can be stored in the optional EEPROM and automatically read at power-on. The data remains in the EEPROM after power-off. "Calibration Mode" can be used on FIT-10/IF by setting the calibration data at "Calibration Setup Mode" at every power-on.

§ Two external switch information can be transmitted with the coordinate data. External circuits can be monitored.

§ The touch signal can be externally transmitted. This signal can be used to have buzzer or LED for touch recognition or to control the external equipment.

§ "Power Saving Mode" is available for the low power consumption requirement. When no input is detected, the mode is automatically switched to "Power Saving Mode."

§ Seven sampling modes (including point mode) can optimize the best sampling speed for various applications.

§ Power can be supplied from RS-232C line. (FIT-10/IF, FIT-10/IF-E)

1-6. General Specifications

Item		Rating	Remarks
Supply Voltage	FIT-10/IC	DC 2.7V to 6.0V	
	FIT-10/IF	DC 4.5V to 5.5V	
	FIT-10/IF-E		
Supply Current	FIT-10/IC	16.4mA (VCC = 5.0V) 7.8mA (VCC = 3.3V)	At sampling Rate = 30p/s
	FIT-10/IF	17.8mA	
	FIT-10/IF-E		
Operating Temp.	FIT-10/IC	-40°C to +85°C (No dew condensation)	
	FIT-10/IF	-10°C to +60°C (No dew condensation)	
	FIT-10/IF-E		
Storing Temp.	FIT-10/IC	-55°C to +150°C (No dew condensation)	
	FIT-10/IF	-25°C to +80°C (No dew condensation)	
	FIT-10/IF-E		
Correspondence	Format	Asynchronous Serial	Fixed value
	Transfer Rate	9600bps	
	Data Format	8bit	
	Stop Bit	1bit	
	Parity	None	
Frequency (FIT-10/IC)		10MHz	10MHz fixed
Sampling Rate (points/sec)		(1) Point Mode (2) 30p/s (3) 50p/s (4) 80p/s (5) 100p/s (6) 130p/s (7) 150p/s	Point Mode: Transmits one pen-down ID when a touch is detected. No pen-up ID is transmitted when the touch leaves the screen.
Resolution		10 bit (1024 x 1024)	Varies if the maximum coordinate is set below 03FF in "Calibration Setup Mode."
Dimension (mm)	FIT-10/IC	24.7(W) x 8.7(D) x 3.35(H)	
	FIT-10/IF	60(W) x 40(D) x 6(H)	
	FIT-10/IF-E		

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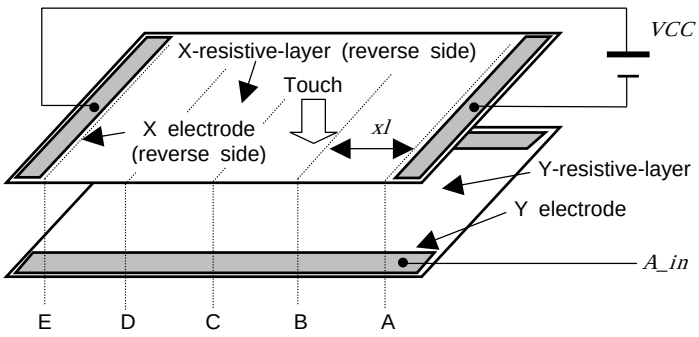
1-7. Peripheral Composition Overview

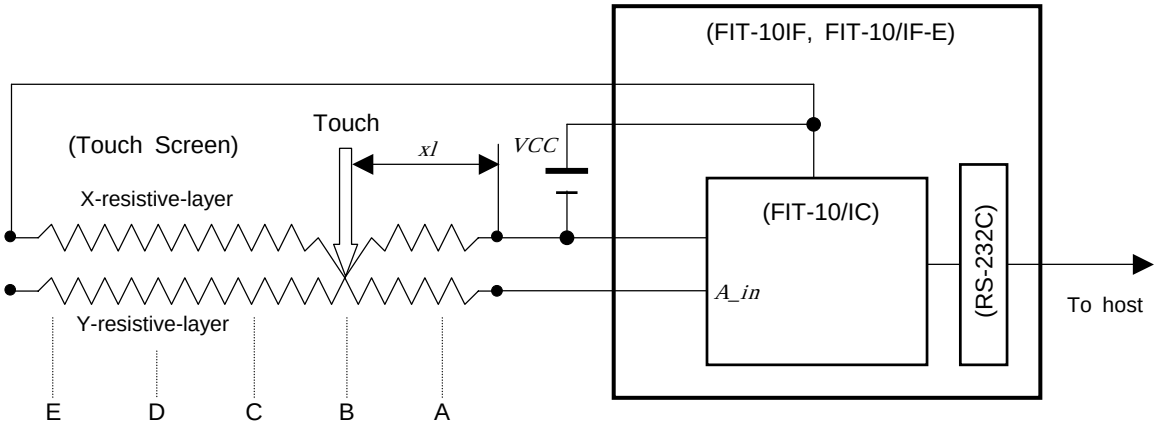
In order to measure the coordinate of the X-resistive-layer, a certain voltage (5V in this case) is needed to be supplied from the peripheral circuit of FIT-10 to the either one of the electrodes of the X-resistive-layer of the touch screen, and the other is needed to be grounded. When the touch screen is depressed, the resistive (conductive) coating of the X-resistive-layer contacts the one of the Y-resistive-layer and the voltage of the X-layer at the contact point (*xl*) is measured on the Y-resistive-layer (*A_in*). This voltage is measured higher on the power source side and results lower on the grounded side. This results *A_in* = *VCC* at E point and *A_in* = 0V at A point. FIT-10/IC computes the coordinate data from *A_in* and transmits the data to the host through RS-232C interface.
The coordinate of Y-resistive layer is measured in the same way and alternating these two resolves the touch position of the touch screen.

§ Example of the relationship between the input points and the output data
(Electrical loss or tolerance of FIT-10, touch screen, and cables are excl uded)



VCC = 5.0V

xl	*A_in*	Output Data
A	0V	0000h (Min.)
B	1.25V	00FFh
C	2.5V	01FFh
D	3.75V	02FFh
E	5V	03FFh (Max.)



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2. Modes

2-1. Overview

§ Initializing Mode

The period between power-on and FIT-10 performs internal initialization to establish correspondence to the host.
EEPROM Data is loaded in this mode if EEPROM is installed.

§ Idling Mode

Waiting mode after the correspondence to the host is established. This mode can be entered by receiving [05h] + either one of [40-45h/50h] (Set Sampling Rate) in "Initialization Mode." Each mode can be entered from this mode.

§ Coordinate Mode

Raw 10bit coordinates are transmitted in this mode. This mode can be entered by receiving either one of [01h/21h/31h] (Start Coordinate Mode) in "Idling Mode" and exited to "Idling Mode" by receiving [02h] (End Coordinate Mode). Receiving [55h] (Reset) switches the modes to "Initialization Mode."

§ Calibration Setup Mode

Setup mode to setup the calibration data used in "Calibration Mode." Receiving [0Dh/0Eh] (Start Setup Mode) switches modes to this mode. Setup is performed by selecting the designated point numbers from X=2, Y=2 (4 point calibration) to X=5, Y=5 (25 point calibration).

§ Calibration Reading Mode (Not applicable to FIT-10/IF)

EEPROM data can be read in this mode if EEPROM is installed. This mode can be used to test the calibration data in EEPROM set in "Calibration Setup Mode." This mode can be entered by receiving [1Dh] (Read Calibration Data) in "Idling Mode."

§ Calibration Mode

Calibrated coordinates are transmitted in this mode. This mode can be used to adjust the touch and the cursor to absorb the electrical loss and tolerance.
The raw coordinate data is calibrated using the data set in "Calibration Setup Mode" and transmitted as calibrated coordinate. This mode employs the function to limit the maximum coordinate.
This mode can be entered by receiving either one of [0Ah/2Ah/3Ah] (Start Calibration Mode) in "Idling Mode" and exited to "Idling Mode" by receiving [0Bh] (End Calibration Mode). Receiving [55h] (Reset) switches the modes to "Initialization Mode."

§ Stop Mode

This mode can be entered by receiving [0Fh] (Start Stop Mode) in "idling Mode." This mode stops the oscillation of the crystal and enables the low power consumption mode. Performing hardware reset switches the modes to "Initialization Mode" or receiving [00h] (Null) releases MPU stop and switches modes to "Idling Mode" after the stabilization time set by terminal 37(P13) and 38(P14) (27ms for FIT-10/IF, FIT-10/IF-E).

§ Power Saving Mode

Power saving is enabled when no touch is detected in 20 sampling duration in "Coordinate Mode" switched by receiving [01h] or "Calibration Mode" switched by receiving [0Ah]. This mode stops the oscillation of the crystal and enables the low power consumption mode. Any input or any command from the host releases this mode and switches modes to "Coordinate Mode" or "Calibration Mode" after the stabilization time set by terminal 37(P13) and 38(P14) (27ms for FIT-10/IF, FIT-10/IF-E).

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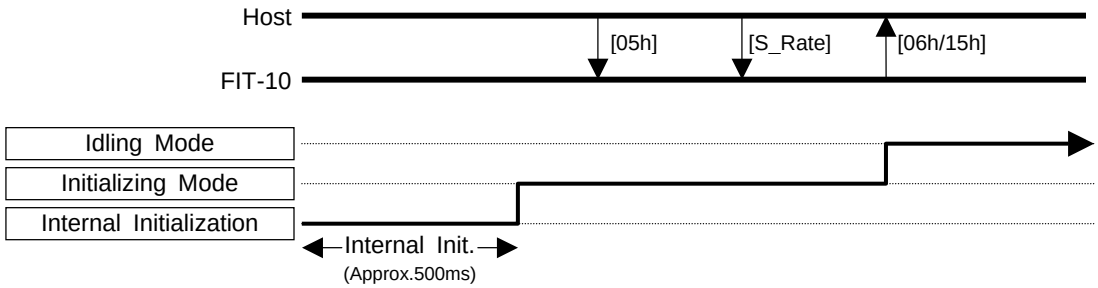
2-2. Initialization Mode and Idling Mode

At power-on, FIT-10 performs internal initialization (approx. 500msec) and enters "Initialization Mode" so that FIT-10 can correspond to the host. Sampling rate can be set and EEPROM data is loaded if EEPROM is installed.
Receiving [05h] + [S_Rate] (Set Sampling Rate) resolves the sampling rate that the coordinate data is transmitted. FIT-10 returns [06h] (ACK) or [15h] (NAK) according to the touch screen and EEPROM data status and switches modes from "Initialization Mode" to "Idling Mode." Each mode can be entered from this mode.

§ Correspondence and Mode Transition



§ Set Sampling Rate (S_Rate) Command

Mode	Sampling	Command	Remarks
Stream	30p/s	40h	
	50p/s	41h	
	80p/s	42h	
	100p/s	43h	
	130p/s	44h	
	150p/s	45h	
Point	Once on touch	50h	No pen-up ID

§ Response (with no EEPROM)

Condition	Response	Format	Description
OK	06h (ACK)	1 byte	Touch screen properly connected
NG	15h (NAK)	1 byte	Touch screen not connected

§ Response (with EEPROM installed)

Condition	Response	Format	Description
OK	06h (ACK)	1 byte	Touch screen connection & EEPROM OK
NG	15h (NAK) + Code		
	bit0=1(01h)	2 byte	No Data in EEPROM
	bit1=1(02h)		EEPROM data error
	bit2=1(04h)		EEPROM writing error
	bit3=1(08h)		Touch screen not connected

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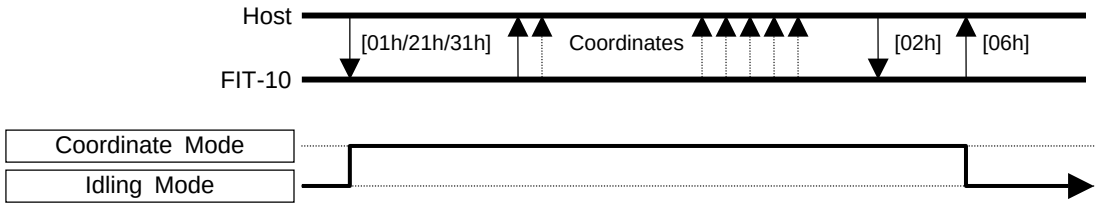
2-3. Coordinate Mode

This mode transmits the raw coordinate data as the result of A/D conversion from the analog input. This mode can be used to obtain the raw data needed to create the calibration data in "Calibration Setup Mode." This mode does not employ the function to limit the maximum coordinate for its function.
This mode can be entered by receiving either one of [01h/21h/31h] (Start Coordinate Mode) in "Idling Mode" and exited to "Idling Mode" by receiving [02h] (End Coordinate Mode). Receiving [55h] (Reset) switches the modes to "Initialization Mode."
1 byte of pen-down ID followed by the coordinate data is transmitted when a touch is detected (when a finger or a pen touches the touch screen), and 1 byte of pen-down ID is transmitted when the touch is terminated (when a finger or a pen leaves the touch screen) (Point Mode excluded).

§ Correspondence and Mode Transition

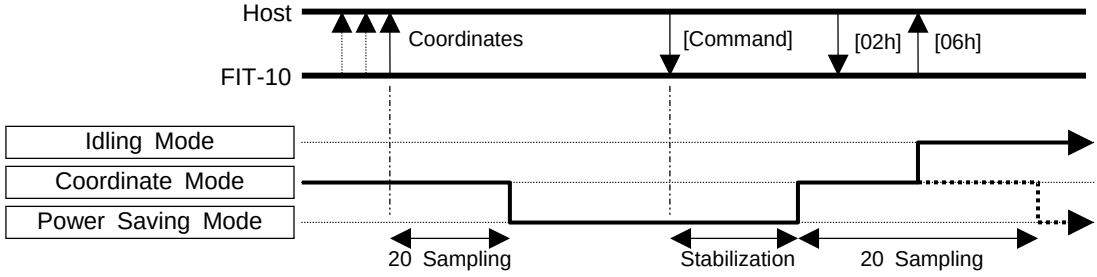


§ Start & End Coordinate Mode Command (1 byte)

Mode	Command	Function
Start Coordinate Data 1	01h	Coordinate data is transmitted according to the sampling rate setting and one pen-up ID is transmitted when touch is terminated. No input for 20 sampling duration enables "Power Saving Mode".
Start Coordinate Data 2	21h	Pen-up IDs are transmitted according to the sampling rate setting and the coordinate data is transmitted when touch is detected. "Power Saving Mode" is disabled.
Start Coordinate Data 3	31h	Coordinate data is transmitted according to the sampling rate setting and one pen-up ID is transmitted when touch is terminated. "Power Saving Mode" is disabled.
End Coordinate Data	02h	Exits "Coordinate Mode" and returns to "Idling Mode." (Applicable to 1-3)

§ Power Saving Mode

"Power Saving Mode" is enabled when no touch is detected in 20 sampling duration in "Coordinate Mode" switched by receiving [01h]. This mode stops the oscillation of the crystal and enables the low power consumption mode. Any input or any command from the host releases this mode and switches modes to "Idling Mode" after the stabilization time set by terminal 37(P13) and 38(P14) (27ms for FIT-10/IF, FIT-10/IF-E).
In order to receive [02h], "Power Saving Mode" must be exited. A command or a touch must be transmitted to exit "Power Saving Mode" and [02h] must be followed before 20 sampling duration elapses.



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§ Data Details

Pen-down ID

Bit Order	7	6	5	4	3	2	1	0
Data	SW0	SW1	0	1	0	0	0	1

Pen-up ID

Bit Order	7	6	5	4	3	2	1	0
Data	SW0	SW1	0	1	0	0	0	0

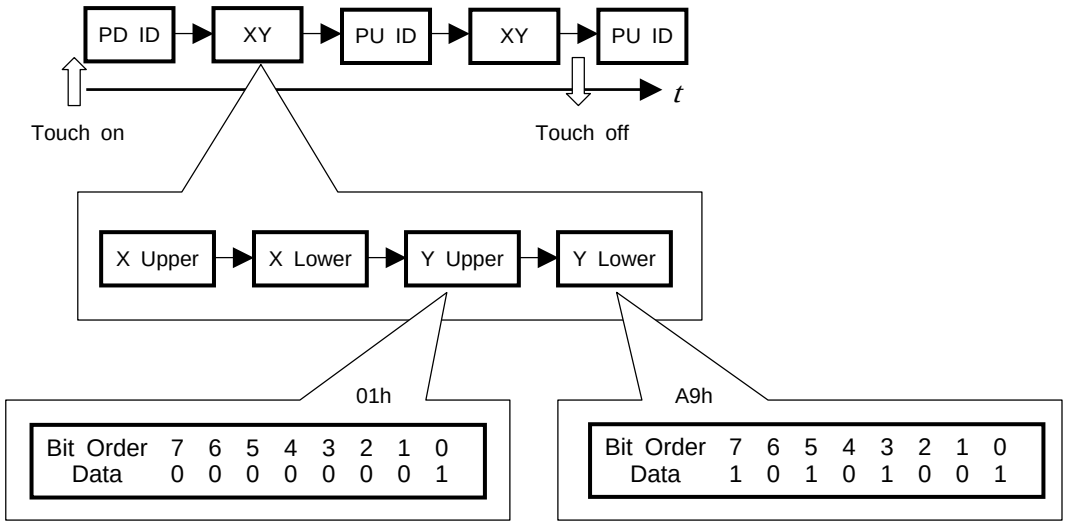
Pen-down ID

ID	SW0	SW1
11h	0	0
51h	0	1
91h	1	0
D1h	1	1

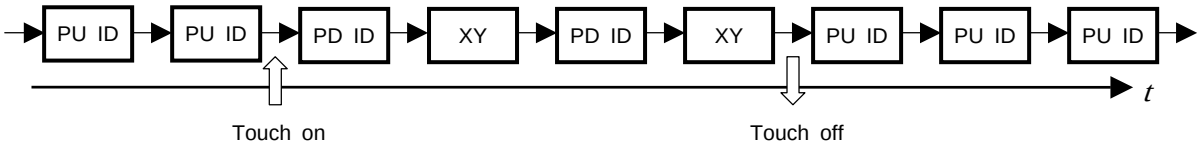
Pen-up ID

ID	SW0	SW1
10h	0	0
50h	0	1
90h	1	0
D0h	1	1

§ Data Example (Started by receiving [01h] or [31h]) (in the case of X = 0374, Y = 01A9)



§ Data Example (Transmitted by receiving [21h]



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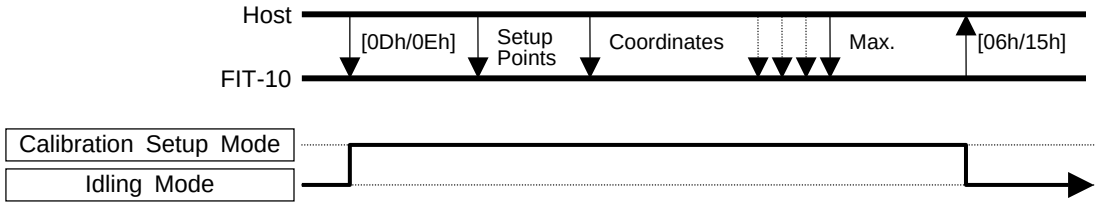
2-4. Calibration Data Setup Mode

The calibration data used in "Calibration Mode" is setup in this mode. Raw coordinate data of the calibration points is needed to setup.
This mode can be entered by receiving [0Dh/0Eh] (Start Setup Mode) in "Idling Mode" and exited to "Idling Mode" with returning [06h/15h] (ACK/NAK) when the setup is completed.
The data can be stored in this mode if EEPROM is installed.

§ Correspondence and Mode Transition



§ Start Setup Mode Command (1byte)

Mode	Command	Function
Start Setup Mode 1	0Dh	Regular calibration setting
Start Setup Mode 2	0Eh	5-point calibration setting

§ Response (with no EEPROM)

Condition	Response	Format	Description
OK	06h (ACK)	1 byte	Setup completed

§ Response (with EEPROM installed)

Condition	Response	Format	Description
OK	06h (ACK)	1 byte	EEPROM writing successful
NG	15h (NAK) + Code		
	bit0=1(01h)	2 byte	No Data in EEPROM
	bit1=1(02h)		EEPROM data error
	bit2=1(04h)		EEPROM writing error
	bit3=1(08h)		Touch screen not connected

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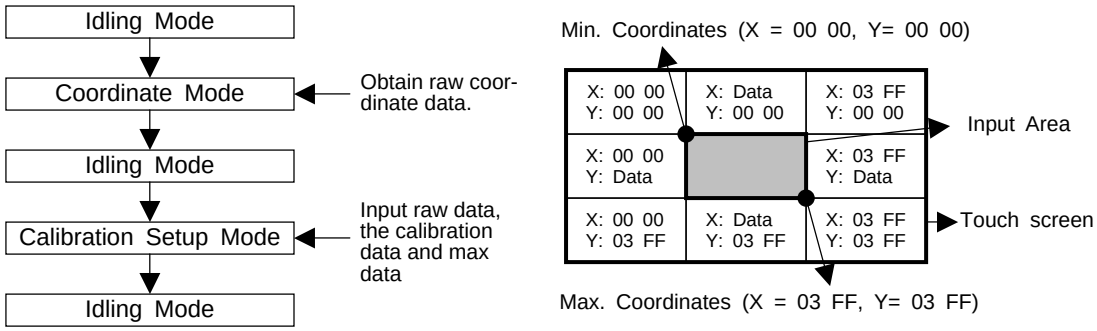
§ Setup Procedure

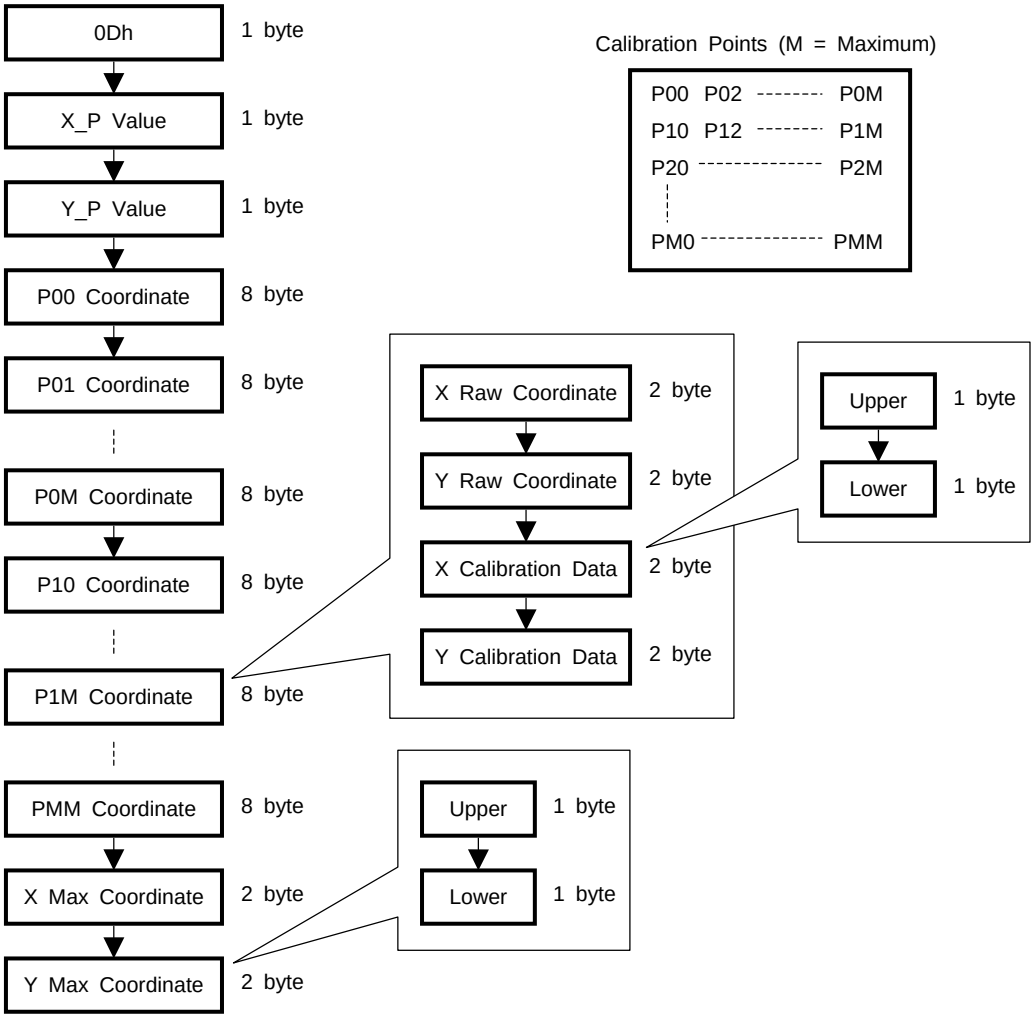
1. Fix the calibration points and numbers, and display the points by an object such as a cross (+) mark or an arrow. Obtain the raw coordinate data in "Coordinate Data Mode."
2. Send [0Dh/0Eh] from the host (to switch to "Calibration Setup Mode." and input the calibration coordinates.

Note: If the input area is set smaller than the physical dimension of the touch screen, following coordinates are transmitted in the outer area.


Idling Mode
Coordinate Mode
Obtain raw coordinate data.
Idling Mode
Calibration Setup Mode
Input raw data, the calibration data and max data
Idling Mode
Min. Coordinates (X = 00 00, Y= 00 00)
X: 00 00 Y: 00 00
X: Data Y: 00 00
X: 03 FF Y: 00 00
Input Area
X: 00 00 Y: Data
X: 03 FF Y: Data
X: 00 00 Y: 03 FF
X: Data Y: 03 FF
X: 03 FF Y: 03 FF
Touch screen
Max. Coordinates (X = 03 FF, Y= 03 FF)

§ Calibration Data Format

Number of calibration points: X-axis = X_P, Y-axis = Y_P (Minimum = 2, Maximum = 5)



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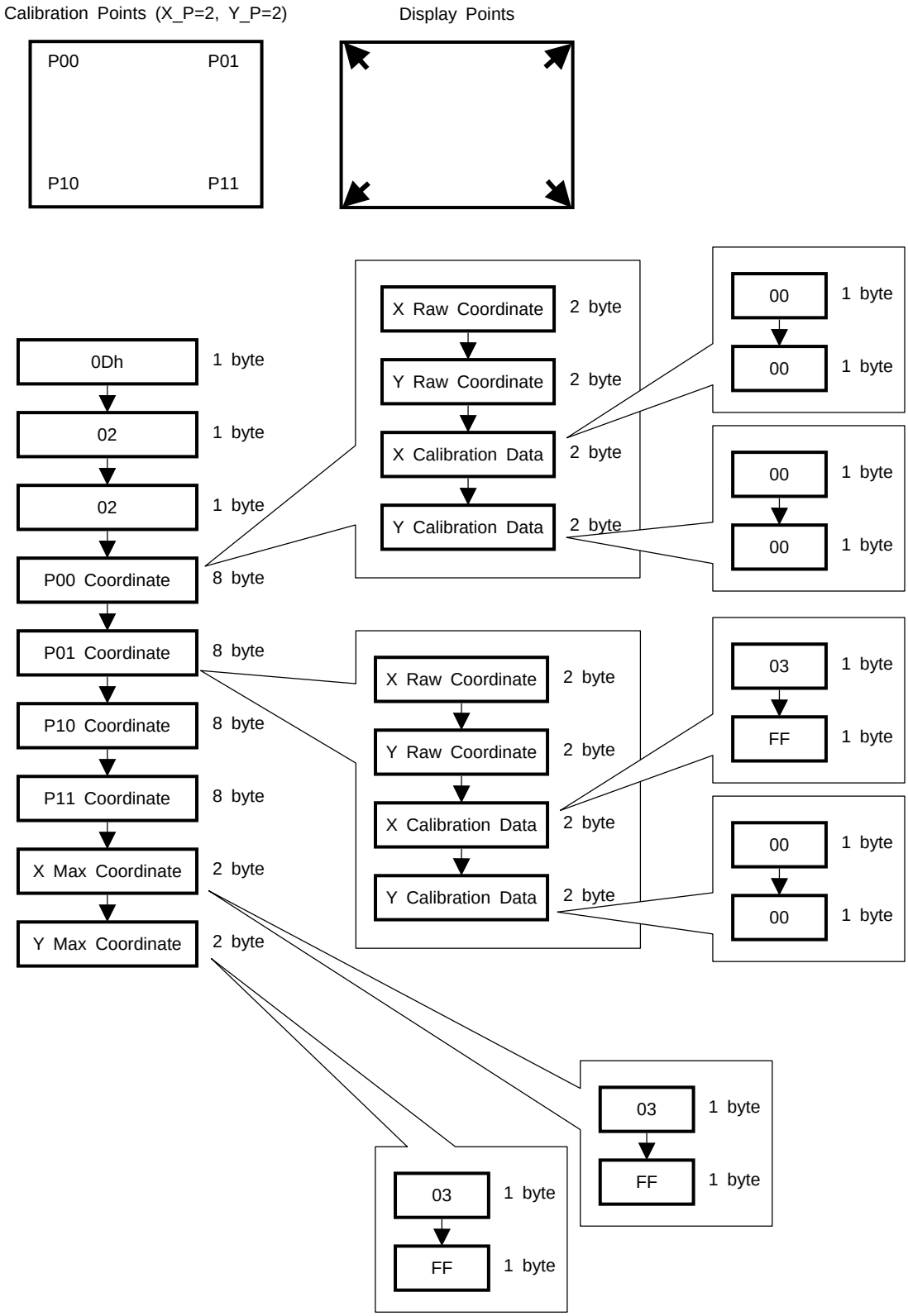
§ Example 1 (Minimum point setting)

X_P = 2, Y_P = 2, X Max Coordinate = 03FF, Y Max Coordinate = 03FF



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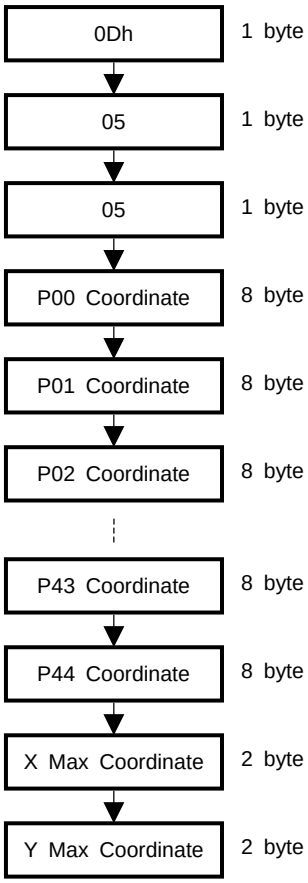
§ Example 2 (Maximum point setting)
X_P = 5, Y_P = 5

Calibration Points (X_P=5, Y_P=5)

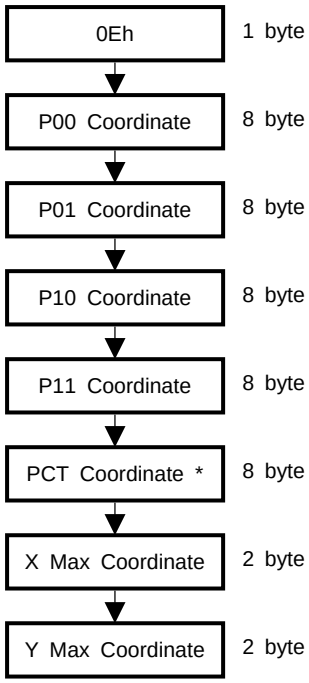
P00	P01	P02	P03	P04
P10	P11	P12	P13	P14
P20	P21	P22	P23	P24
P30	P31	P32	P33	P34
P40	P41	P42	P43	P44



§ Example 3 (5 point setting)

Calibration Points

P00	P01
PCT	
P10	P11



* PCT must be in the middle of P00, P01, P10, P11.

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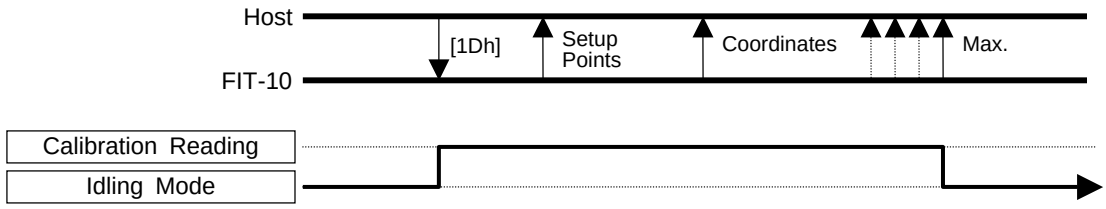
2-5. Calibration Reading Mode

The calibration data stored in EEPROM can be read in this mode. This mode is used to verify the setting or testing the calibration data. Not used on FIT-10/IF.
This mode can be entered by receiving [1Dh] (Load Calibration Data) in "Idling Mode" and exited to "Idling Mode" when the transmission is completed.

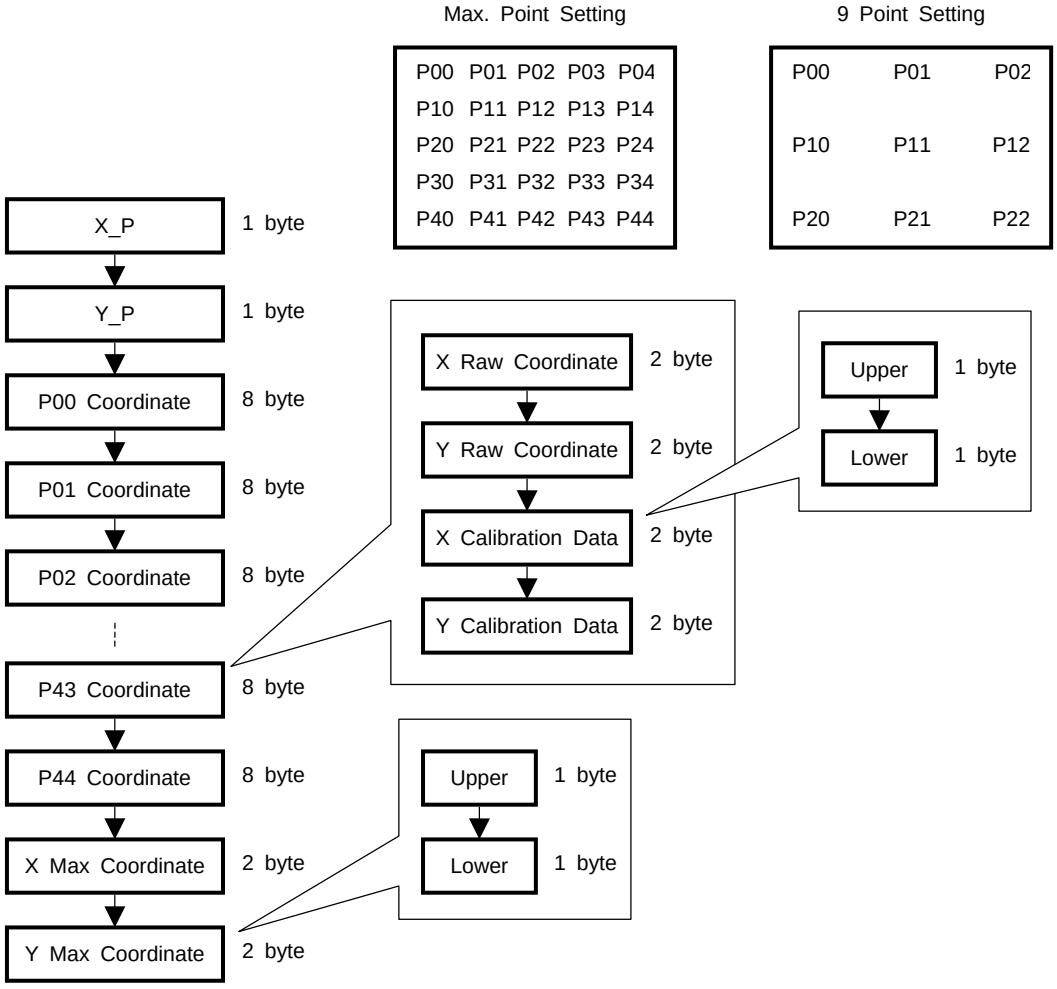
§ Correspondence and Mode Transition



§ Calibration Data Format

Regardless the number of calibration point setting, the calibration data is transmitted in the format of max point setting (25 point setting) except that 5 point setting is transmitted in the format of 9 point setting.

Number of calibration points: X-axis = X_P, Y-axis = Y_P (Minimum = 2, Maximum = 5)


Max. Point Setting
P00 P01 P02 P03 P04
P10 P11 P12 P13 P14
P20 P21 P22 P23 P24
P30 P31 P32 P33 P34
P40 P41 P42 P43 P44
9 Point Setting
P00 P01 P02
P10 P11 P12
P20 P21 P22
X_P 1 byte
Y_P 1 byte
P00 Coordinate 8 byte
P01 Coordinate 8 byte
P02 Coordinate 8 byte
P43 Coordinate 8 byte
P44 Coordinate 8 byte
X Max Coordinate 2 byte
Y Max Coordinate 2 byte
X Raw Coordinate 2 byte
Y Raw Coordinate 2 byte
X Calibration Data 2 byte
Y Calibration Data 2 byte
Upper 1 byte
Lower 1 byte
Upper 1 byte
Lower 1 byte

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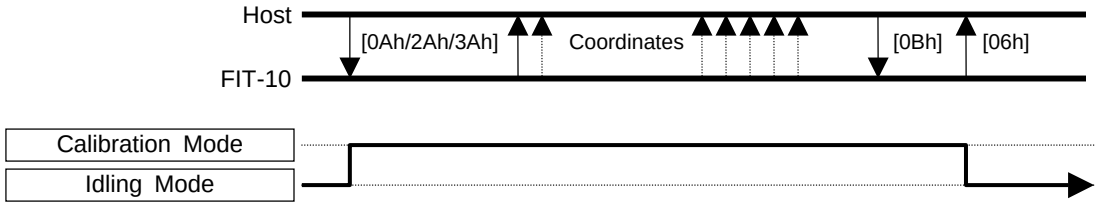
2-6. Calibration Mode

This mode transmits the calibrated coordinates using the data set in "Calibration Setup Mode." This mode can be used to adjust the touch and cursor to absorb the electrical loss and tolerance.
This mode employs the function to limit the maximum coordinate for its function.
This mode can be entered by receiving either one of [0Ah/2Ah/3Ah] (Start Calibration Mode) in "Idling Mode" and exited to "Idling Mode" by receiving [0Bh] (End Calibration Mode). Receiving [55h] (Reset) switches the modes to "Initialization Mode."
1 byte of pen-down ID followed by the coordinate data is transmitted when a touch is detected (when a finger or a pen touches the touch screen), and 1 byte of pen-down ID is transmitted when the touch is terminated (when a finger or a pen leaves the touch screen) (point mode excluded).

§ Correspondence and Mode Transition

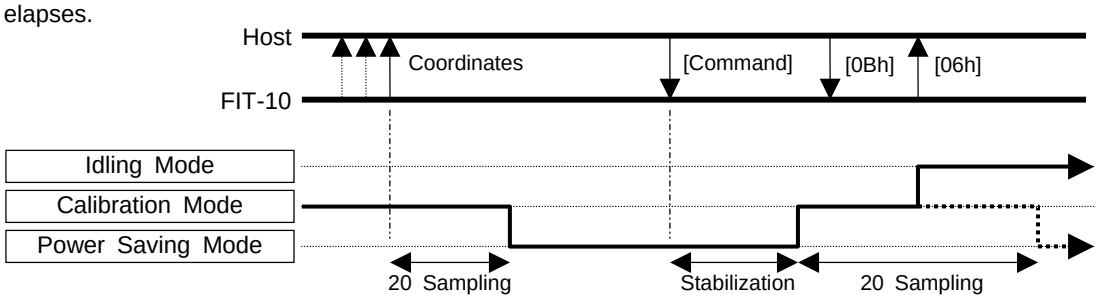


§ Start & End Calibration Mode Command (1 byte)

Mode	Command	Function
Start Calibration Data 1	0Ah	Coordinate data is transmitted according to the sampling rate setting and one pen-up ID is transmitted when touch is terminated. No input for 20 sampling duration enables "Power Saving Mode".
Start Calibration Data 2	2Ah	Pen-up IDs are transmitted according to the sampling rate setting and the coordinate data is transmitted when touch is detected. "Power Saving Mode" is disabled.
Start Calibration Data 3	3Ah	Coordinate data is transmitted according to the sampling rate setting and one pen-up ID is transmitted when touch is terminated. "Power Saving Mode" is disabled.
End Calibration Data	0Bh	Exits "Calibration Mode" and returns to "Idling Mode." (Applicable to 1-3)

§ Power Saving Mode

"Power Saving Mode" is enabled when no touch is detected in 20 sampling duration in "Calibration Mode" switched by receiving [0Ah]. This mode stops the oscillation of the crystal and enables the low power mode. Any input or any command from the host releases this mode and switches modes to "Idling Mode" after the stabilization time set by terminal 37(P13) and 38(P14) (27ms for FIT-10/IF, FIT-10/IF-E).
In order to receive [0Bh], "Power Saving Mode" must be exited. A command or a touch must be transmitted to exit "Power Saving Mode" and [0Bh] must be followed before 20 sampling duration elapses.



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§ Data Details

Pen-down ID

Bit Order	7	6	5	4	3	2	1	0
Data	SW0	SW1	0	1	0	0	0	1

Pen-up ID

Bit Order	7	6	5	4	3	2	1	0
Data	SW0	SW1	0	1	0	0	0	0

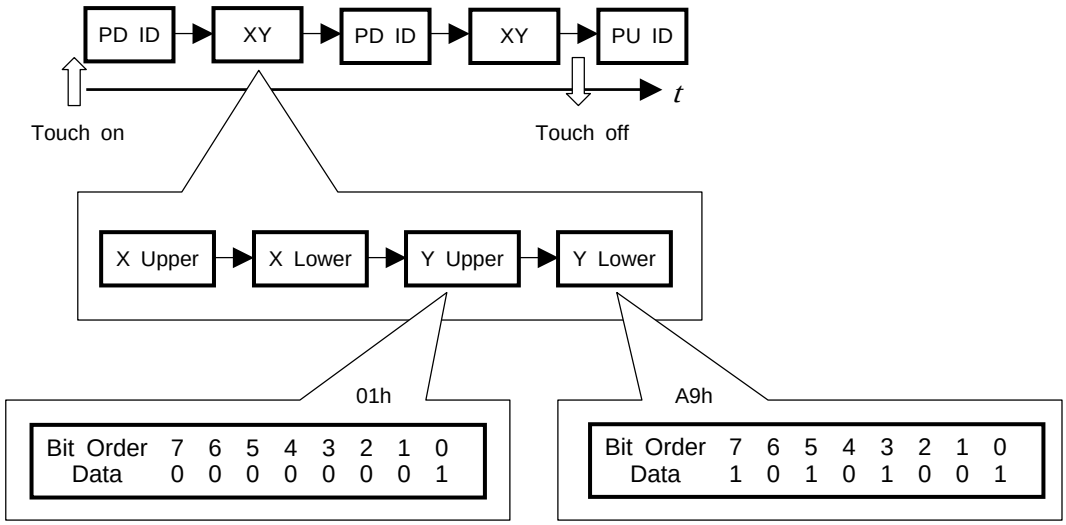
Pen-down ID

ID	SW0	SW1
11h	0	0
51h	0	1
91h	1	0
D1h	1	1

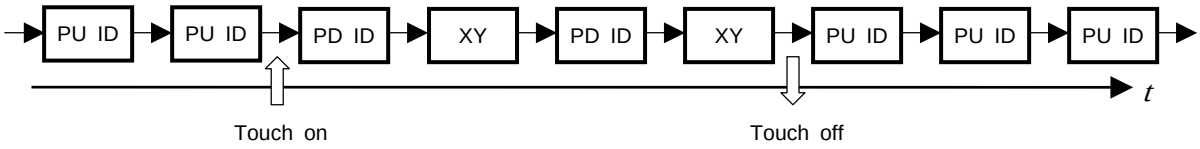
Pen-up ID

ID	SW0	SW1
10h	0	0
50h	0	1
90h	1	0
D0h	1	1

§ Data Example (Started by receiving [0Ah] or [3Ah]) (in the case of X = 0374, Y = 01A9)



§ Data Example (Transmitted by receiving [2Ah]



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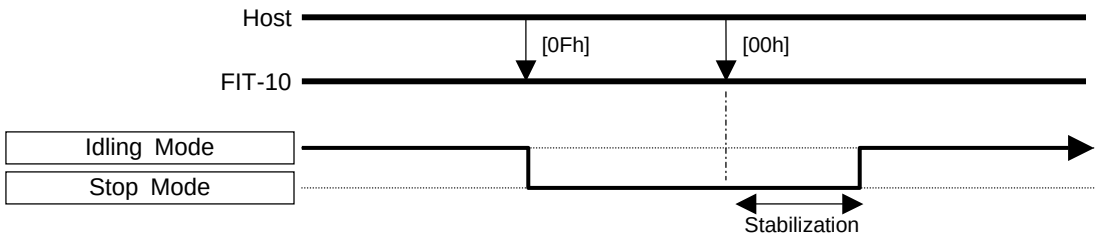
2-7. Stop Mode

This mode can be entered by receiving [0Fh] (Start Stop Mode) in "idling Mode." This mode stops the oscillation of the crystal and enables the low power consumption mode. Performing hardware reset switches the modes to "Initializing Mode" or receiving [00h] (Null) releases MPU stop and switches modes to "Idling Mode" after the stabilization time set by terminal 37(P13) and 38(P14) (27ms for FIT-10/IF, FIT-10/IF-E).



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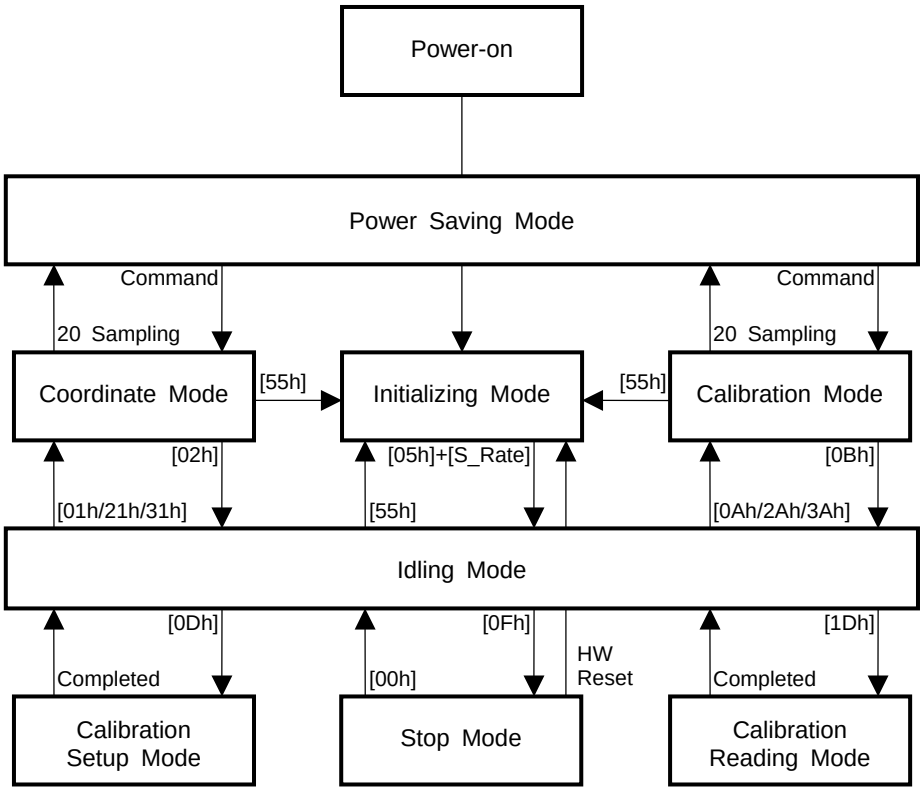
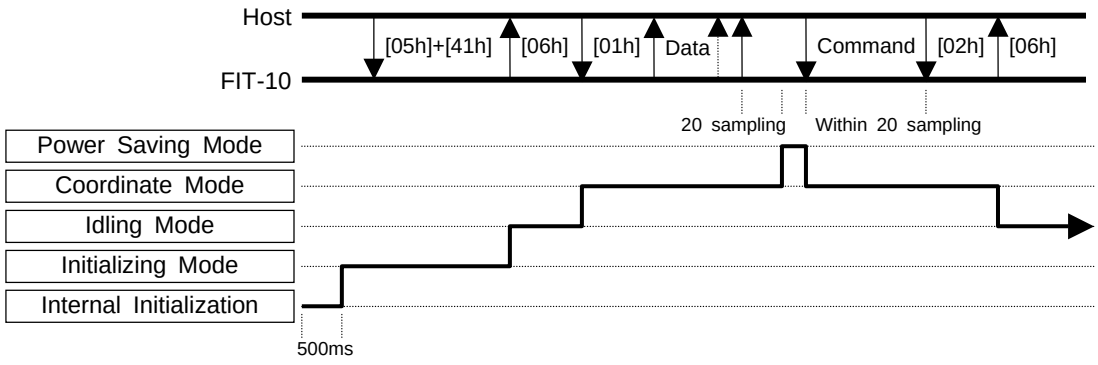
2-8 Mode Chart



2-9 Mode Transition Example

§ Example 1 (Coordinate Mode)
Sampling Rate = 50p/s, "Power Saving Mode" ON



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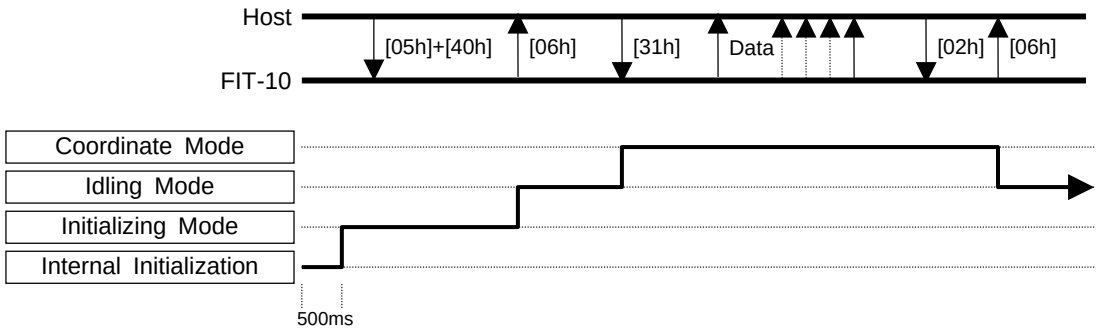
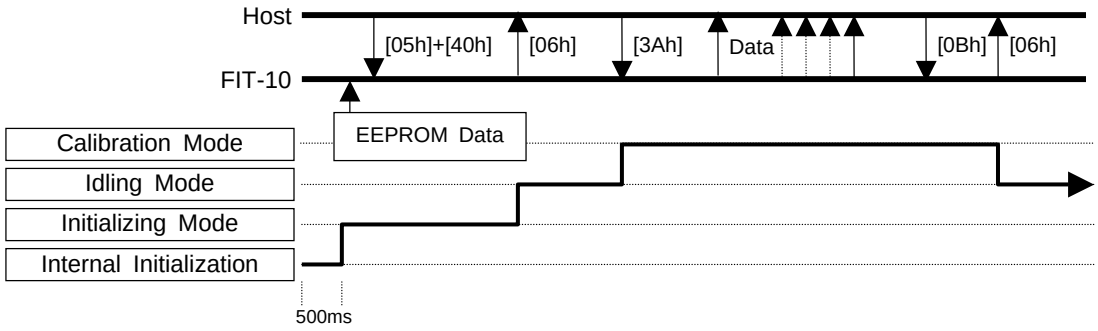
§ Example 2 (Coordinate Mode)

Sampling Rate = 30p/s, "Power Saving Mode" OFF
(Recommended setting if power is supplied from RS-232C)



§ Example 3 (Calibration Mode)

Sampling Rate = 30p/s, Power Saving OFF
(Recommended setting if power is supplied from RS-232C)



2-10. List of Command/Responses

Command	Name	Direction
05h	Set Sampling Rate	Host to FIT-10
01h	Start Coordinate Mode 1	Host to FIT-10
21h	Start Coordinate Mode 2	Host to FIT-10
31h	Start Coordinate Mode 3	Host to FIT-10
02h	End Coordinate Mode	Host to FIT-10
0Dh	Start Setup Mode	Host to FIT-10
1Dh	Read Calibration Data	Host to FIT-10
0Ah	Start Calibration Mode 1	Host to FIT-10
2Ah	Start Calibration Mode 2	Host to FIT-10
3Ah	Start Calibration Mode 3	Host to FIT-10
0Bh	End Calibration Mode	Host to FIT-10
0Fh	Start Stop Mode	Host to FIT-10
00h	Null	Host to FIT-10
55h	Reset	Host to FIT-10
10h	Pen-up ID	FIT-10 to Host
11h	Pen-down ID	FIT-10 to Host
06h	ACK	FIT-10 to Host
15h	NAK	FIT-10 to Host

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3. Data Sheet

3-1. Terminal Function

§ FIT-10/IC

Terminal	Name	Function
1	P52	Open
2	P51	Buzzer Output (N-ch Open-drain Output)
3	P50	Open
4	P60/AN0	A/D Converter Input 0 (to XR)
5	P61/AN1	A/D Converter Input 1 (to XL)
6	P62/AN2	A/D Converter Input 2 (to YD)
7	P63/AN3	A/D Converter Input 3 (to YU)
8	P64	Open
9	P65	Open
10	P66	Open
11	P67	Open
12	AVCC	A/D Converter Power (to VCC)
13	AVR	A/D Converter Reference Power (to AVCC)
14	AVSS	A/D Converter VSS (to VSS)
15	P74	Open
16	P73	RD Input
17	P72	YU Input
18	P71	Crystal (to VSS)
19	P70	Crystal (Open)
20	RST	Reset Input
21	MOD0	Mode Set (to VSS)
22	MOD1	Mode Set (to VSS)
23	X0	Crystal
24	X1	Crystal
25	VSS	Power (GND)
26	P27	Open
27	P26	Open
28	P25	Open
29	P24	Open
30	P23	Open
31	P22	Open
32	P21	Open
33	P20	Open
34	P17/SW0	SW0 Input (H: OFF, L: ON (BIT7 = 1 when ON) *1
35	P16/SW1	SW1 Input (H: OFF, L: ON (BIT6 = 1 when ON) *1
36	P15/EEPROM_SEL	EEPROM Use (H: Yes, L: No)
37	P14	Stabilization Time: L L → 0ms (External); L H → 2ms; H L → 14ms; H H → 27ms
38	P13	
39	P12	Open
40	P11	Open
41	P10	Open
42	P07	Open
43	P06	Open
44	P05	Open
45	P04	YD Control 2
46	P03	YU Control 1
47	P02	YD Control 1

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48	P01	XL Control 1
49	P00	XR Control 1
50	VSS	Power (GND)
51	P37	YU Control 3
52	P36	XL Control 2
53	P35	Open
54	P34	Open
55	P33	Open
56	P32/RD	Data Input
57	VCC	Power (+5V)
58	P31/SD	Data Output
59	P30	Open
60	P43/EEP_DO	EEPROM DO Input *2
61	P42/EEP_DI	EEPROM DI Output *2
62	P41/EEP_SK	EEPROM SK Output *2
63	P40/EEP_CS	EEPROM CS Output *2
64	P53	Open

*1: 34 and 35 should be connected to VCC (+5V) if SW0, SW1 are not used.

*2: 61, 62, 63 should be open and 60 should be connected to VCC if EEPROM is not used.

* All the "Open" terminal must be open. Connecting those terminals to VCC, VSS, or other circuit may cause malfunction.

§ FIT-10/IF, FIT-10/IF-E

CN	Terminal	Name	Function
CN1	1	XL	Touch screen Input 0 (XL) (Open if CN2 is used)
	2	YU	Touch screen Input 1 (YU) (Open if CN2 is used)
	3	XR	Touch screen Input 2 (XR) (Open if CN2 is used)
	4	YD	Touch screen Input 3 (YD) (Open if CN2 is used)
CN2	1	YD	Touch screen Input 0 (YD) (Open if CN1 is used)
	2	XL	Touch screen Input 1 (XL) (Open if CN1 is used)
	3	YU	Touch screen Input 2 (YU) (Open if CN1 is used)
	4	XR	Touch screen Input 3 (XR) (Open if CN1 is used)
	5		Open
CN3	1	Dout	RS-232C Data Output
	2	Din	RS-232C Data Input
	3	GND	RS-232C GND
	4	Vin	RS-232C Power (Open if power is supplied from CN5)
	5	Vin	RS-232C Power (Open if power is supplied from CN5)
CN4	1	Vin	Power (+5V) (For Voltage Monitor)
	2	BZ	Buzzer (50ms pulse at 2.5kHz on touch)
	3	GND	Power (GND)
	4	SW1	SW1 Input (H: OFF, L: ON (BIT6 = 1 when ON)
	5	SW0	SW0 Input (H: OFF, L: ON (BIT7 = 1 when ON)
CN5	1	Vin	Power (+5V)
	2	Vin	Power (+5V)
	3	TTLout	TTL Data Output
	4	TTLin	TTL Data Input
	5		Open
	6	RST	Reset Input
	7	GND	Power (GND) (Open if power is supplied from CN3)
	8	GND	Power (GND) (Open if power is supplied from CN3)

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3-2. Maximum Specification

§ FIT-10/IC

(AVSS = VSS = 0.0V)

Item	Symbol	Rating		Unit	Remarks
		Min	Max		
Supply Voltage	VCC	VSS-0.3	VSS+7.2	V	AVCC and VCC must be in the same potential. VCC must not exceed AVCC i.e. at power-on.
	AVCC	VSS-0.3	VSS+7.2	V	
	AVR	VSS-0.3	VSS+7.2 AVCC+0.3	V V	Must satisfy both values.
Input Voltage	VI	VSS-0.3	VCC+0.3	V	
	VI2	VSS-0.3	VSS+7.0	V	P51 only
Output Voltage	VO	VSS-0.3	VCC+0.3	V	
	VO2	VSS-0.3	VSS+7.0	V	P51 only
L Level Output Current	IOL		20	mA	Peak
	IOLAV		4	mA	Average
L Level Total Output Current	IOL		100	mA	Peak
	IOLAV		40	mA	Average
H Level Output Current	HOL		-20	mA	Peak
	HOLAV		-4	mA	Average
H Level Total Output Current	HOL		-50	mA	Peak
	HOLAV		-20	mA	Average
Power Consumption	PD		500	mW	
Operating Temp.	TA	-40	+85	°C	
Storing Temp.	Tstg	-55	+150	°C	

3-3. Recommended Specification

§ FIT-10/IC

(AVSS = VSS = 0.0V)

Item	Symbol	Rating		Unit	Remarks
		Min	Max		
Supply Voltage	VCC	2.7	6.0	V	
H Input Voltage	VIH	0.8VCC	VCC+0.3	V	
L Input Voltage	VIL	VSS-0.3	0.2VCC	V	
Clock Frequency	fCH		10.0	MHz	10MHz Fixed

§ FIT-10/IF, FIT-10/IF-E

Item	Symbol	Rating		Unit	Remarks
		Min	Max		
Voltage (CN5)	VCC	4.5	5.5	V	
H Input Voltage	VIH	0.8Vin	Vin+0.3	V	
L Input Voltage	VIL	-0.3	0.2Vin	V	

* A stable power source is required when power is supplied to CN5 to avoid malfunction caused by sudden voltage change. The power needs to be supplied to either one of CN3 or CN5.

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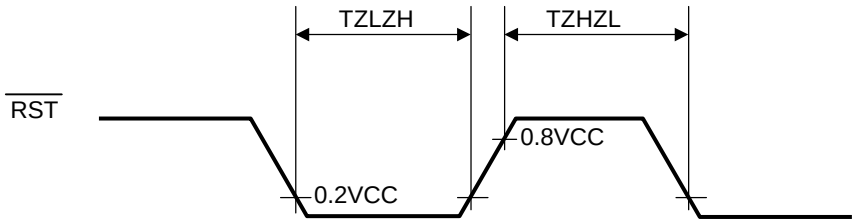
3-4. AC Specification

§ Reset Timing
FIT-10/IF, FIT-10/IF-E, FIT-10/IC

(VCC = 5V±10%)

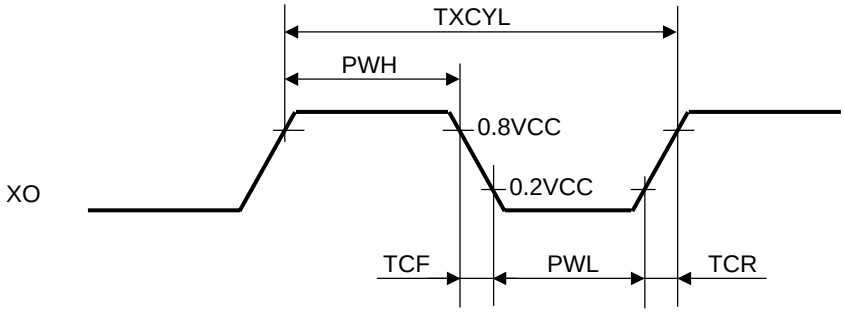
Item	Symbol	Rating		Unit	Remarks
		Min	Max		
RST L Width	TZLZH	48TXCYL		ns	
RST H Width	TZHZL	24TXCYL		ns	



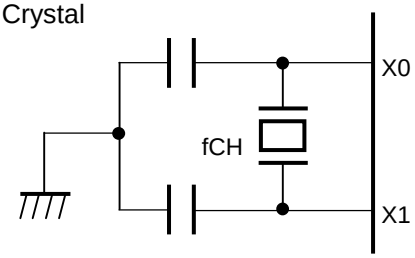
§ Clock Timing
FIT-10/IC

(VCC = 5V±10%)

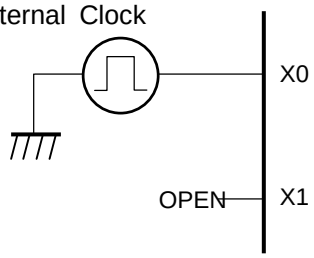
Item	Symbol	Rating		Unit	Remarks
		Min	Max		
Clock Frequency	fCH		10.0	MHz	10MHz Fixed
Clock Pulse Width	PWH/L	20		ns	For External Clock
Rising/Falling Time	TCR/TCF		10	ns	



Crystal



External Clock



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3-5. DC Specification

§ FIT-10/IC

(VCC = 5.0V)

Item	Symbol	Condition	Specification			Unit	Remarks
			Min	Reg	Max		
H Voltage	VOH	IOH=-2.0mA	2.4			V	
L Voltage	VOL	IOL=1.8mA			0.4	V	
Supply Current	ICC1	Idling Mode		16.3		mA	FIT-10/IC Supply Current
	ICC2	Data Transmission		16.4		mA	
	ICC3	Stop Mode			10	uA	
Supply Current	I30	Data Transmission At Touch on		17.8		mA	FIT-10/IC Circuit Current Actual Value at X=415 Y=299
	I50			18.8		uA	
	I80			20.5		mA	
	IPOFF	Power Saving			10	uA	
	IIDOL	Idling Mode		16.4		mA	
	ISTOP	Stop Mode			10	uA	

(VCC = 3.3V)

Item	Symbol	Condition	Specification			Unit	Remarks
			Min	Reg	Max		
H Voltage	VOH	IOH=-1.5mA	1.5			V	
L Voltage	VOL	IOL=1.0mA			0.4	V	
Supply Current	ICC1	Idling Mode		7.8		mA	FIT-10/IC Supply Current
	ICC2	Data Transmission		7.8		mA	
	ICC3	Stop Mode			10	uA	
Supply Current	I30	Data Transmission At Touch on		8.8		mA	FIT-10/IC Circuit Current Actual Value at X=415 Y=299
	I50			9.5		mA	
	I80			10.5		mA	
	IPOFF	Power Saving			10	uA	
	IIDOL	Idling Mode		8.0		mA	
	ISTOP	Stop Mode			10	uA	

§ FIT-10/IF, FIT-10/IF-E

(Vin = 5.0V)

Item	Symbol	Condition	Specification			Unit	Remarks
			Min	Reg	Max		
H Voltage	VOH	IOH=-2.0mA	2.4			V	
L Voltage	VOL	IOL=1.8mA			0.4	V	
Supply Current (CN5)	I30	Data Transmission At Touch on		17.8		mA	FIT-10/IF, FIT-10/IF-E Circuit Current Actual Value at X=415 Y=299
	I50			18.8		uA	
	I80			20.5		mA	
	IPOFF	Power Saving			10	uA	
	IIDOL	Idling Mode		16.4		mA	
	ISTOP	Stop Mode			10	uA	

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4. Changes & Improvements

4-1. Version History

§ FIT-10/IC

VER1.0 to VER2.0

Fixed the problem that FIT-10 freezes on certain IBM PC/AT compatibles at startup and mode transition.
Added capability to supply power from RS-232C.

§ FIT-10/IF, FIT-10/IF-E

VER1.0 to VER 2.0

Circuit change for FIT-10/IC change.
RS-232C interface circuit change and power line addition.
3-pin to 5-pin change on CN3 for the power line.
Added surge protection circuit.
Connector no. change.

VER2.0 to Rev. C

Fixed the problem that 2.54mm pitch connector cannot be mounted on CN2.

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5. Precautions for Use

5-1. General Handling

§ Keep the product away from any conductive objects while in use.

§ Do not touch the conductive part of the product to avoid being damaged by the electrostatic discharge. Follow the proper procedure for handling.

§ Keep the product in the proper storing environment and avoid any load to the product.

§ Do not use or store the product in the severe condition like following:

Wet environment or a condition where the product is likely to get wet.
Where dew condensation is likely to occur.
Near solvent or acid.

§ Do not take apart or alter the product.

5-2. Others

§ The contents of this document are subject to change without notice.

§ The manufacturer or sales representatives will not be liable for any damages or loss arising from use of this product.

§ This product is intended for use in standard applications (computers, office automation, and other office equipment, industrial, communications, and measurement equipment, personal and household devices, etc.) Please avoid using this product for special applications where failure or abnormal operation may directly affect human lives, or cause physical injury or property damage, or where extremely high levels of reliability are required (such as aerospace systems, vehicle operating control, atomic energy controls, medical devices for life support, etc.).

§ Any semiconductor devices have inherently a certain rate of failure. The user must protect against injury, damage, or loss from such failures by incorporating safety design measures into the user's facility and equipment.

FIT-10 Series User's Guide
Rev. 3.6, April 1, 2002
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DMC Co., Ltd. Interface with Touch

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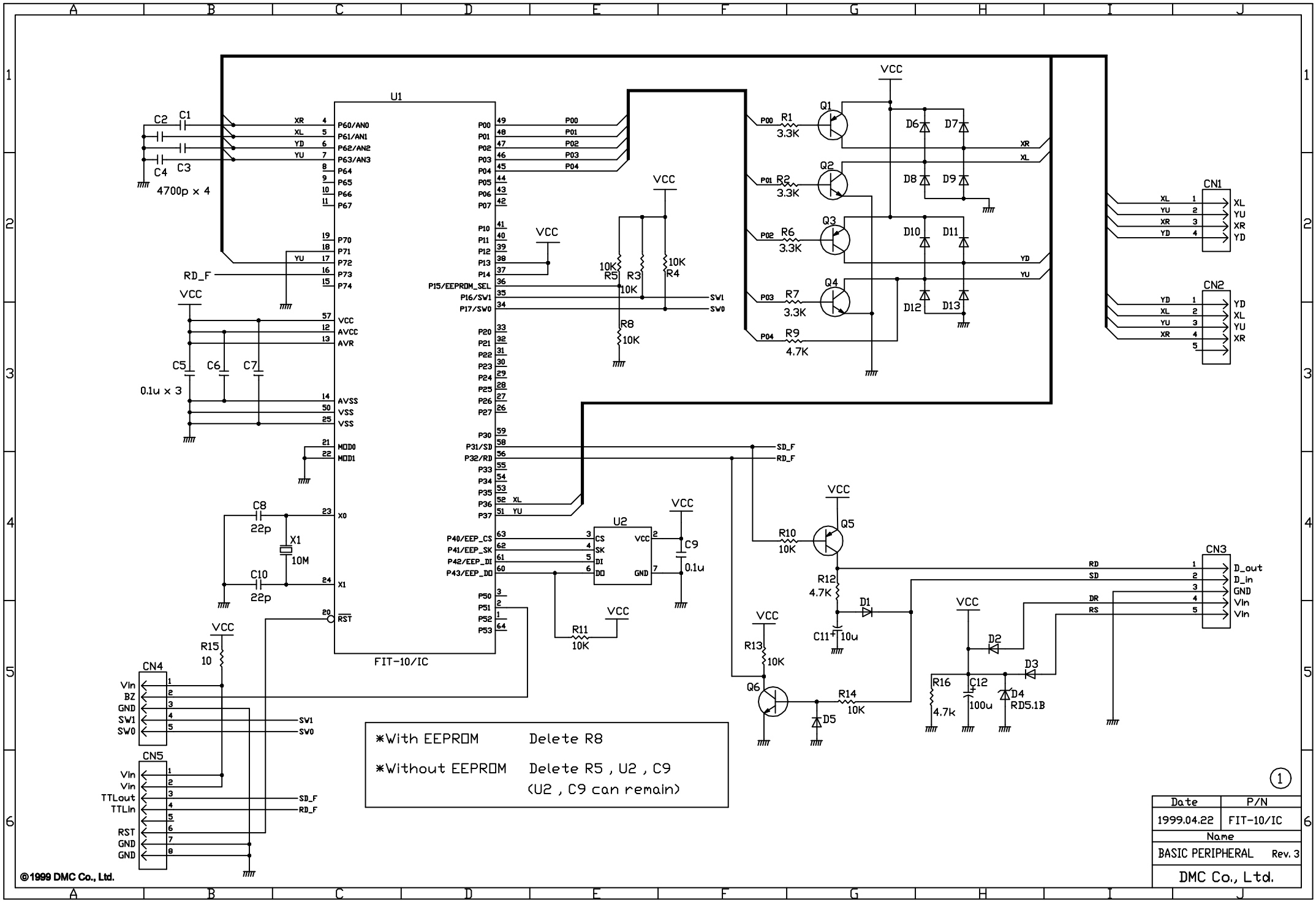

*With EEPROM Delete R8

*Without EEPROM Delete R5 , U2 , C9
(U2 , C9 can remain)

Date	P/N
1999.04.22	FIT-10/IC
Name	
BASIC PERIPHERAL	Rev. 3
DMC Co., Ltd.	

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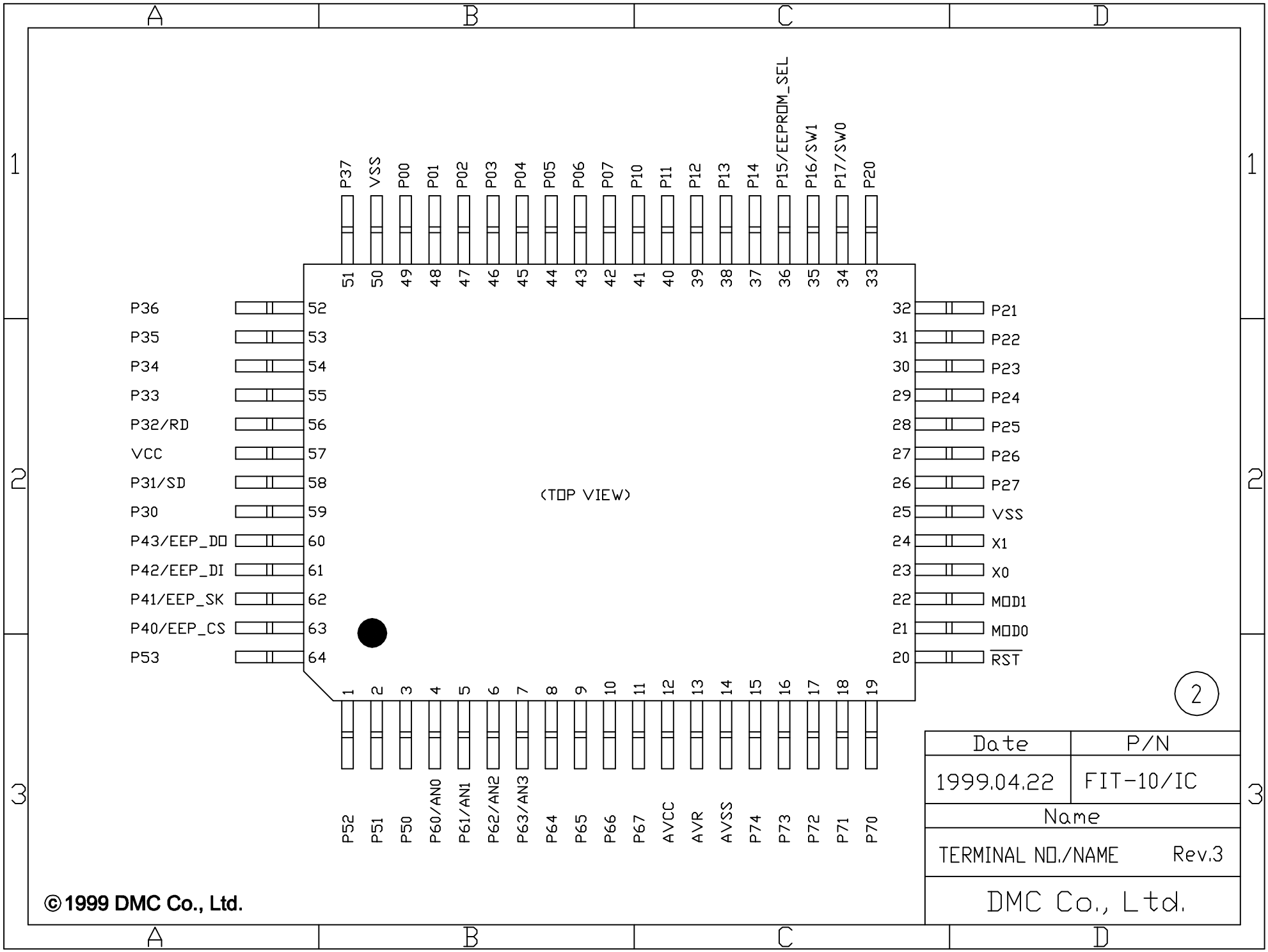

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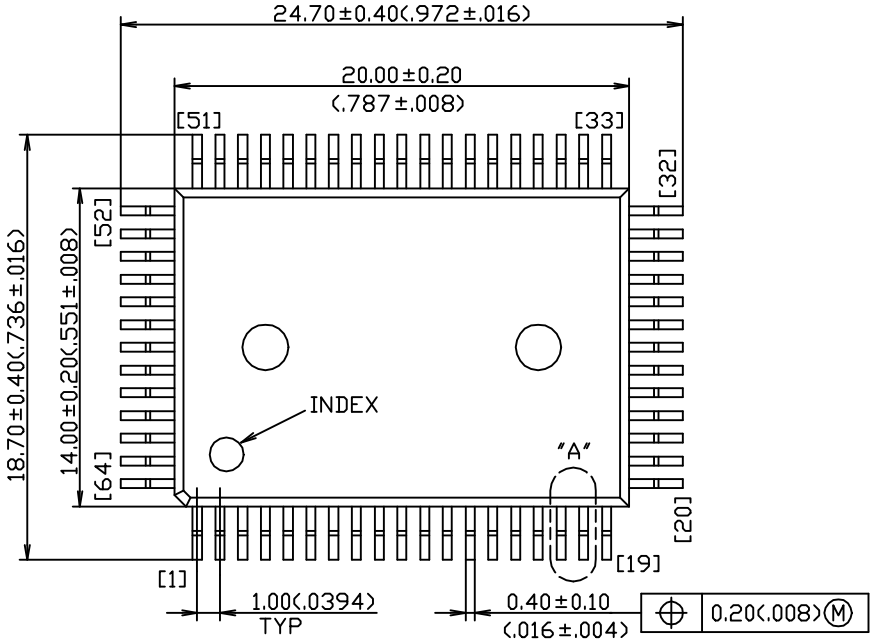

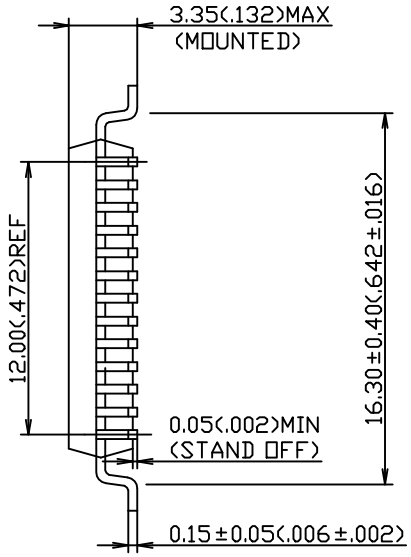

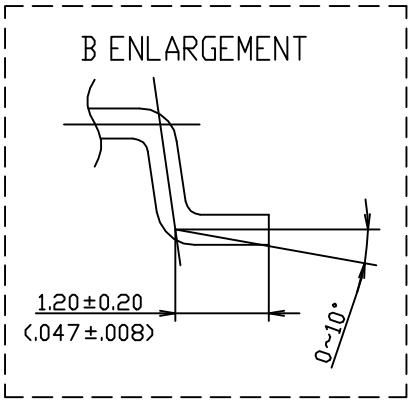

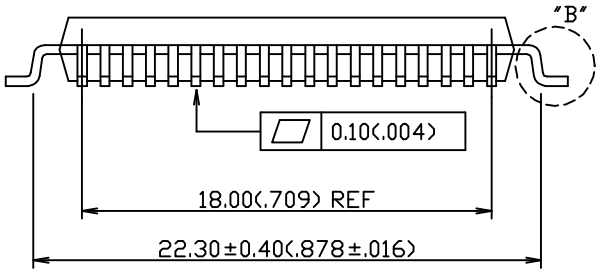

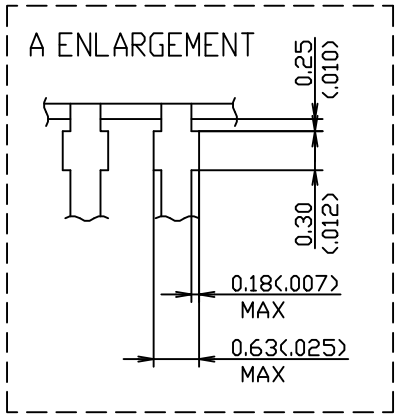

3

Date	P/N
1999.04.22	FIT-10/IC
Name	
EXTERNAL DIMENSIONS Rev.3	
DMC Co., Ltd.	

* [] = Terminal No.
* unit = mm (inch)

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No.	Qty.	P/N	Type	Specification	Recommended	
1	1	U1	IC		FIT-10/IC	DMC
2	1	U2	IC (EEPROM)		S29130AFJ	Seiko Instrument (equivalent)
3	3	Q1,Q3,Q5	Transistor		2SA1036K	ROHM(equivalent)
4	3	Q2,Q4,Q6	Transistor		2SC2412K	ROHM(equivalent)
5	4	D1,D2,D3,D5	Diode		1SS355	ROHM(equivalent)
6	1	D4	Zener Diode	5.1V 1/2W	RD5.1B	NEC(equivalent)
7	1	X1	Crystal	10MHz 12pF ± 30ppm	AT-49	Daishinku(equivalent)
8	4	R1,R2,R6,R7	Resistor	1/8W 3.3KΩ 5%	MCR10EZHJ332	ROHM(equivalent)
9	2	R9,R12	Resistor	1/8W 4.7KΩ 5%	MCR10EZHJ472	ROHM(equivalent)
10	7	R3,R4,R8 R10,R11,R13 R14	Resistor	1/8W 10KΩ 5%	MCR10EZHJ103	ROHM(equivalent)
11	2	C8,C10	Condenser	22pF 10%	GRM40CH220K50PT	Murata(equivalent)
12	4	C1,C2,C3,C4	Condenser	4700pF 10%	GRM40B472K50PT	Murata(equivalent)
13	3	C5,C6,C7	Condenser	0.1μF 10%	GRM40B104Z50PT	Murata(equivalent)
14	1	C11	Chemical Condenser	10μF 16V	UWV1C100MCR2	Nichicon(equivalent)
15	1	C12	Chemical Condenser	100μF 10V	UWV1A101MCR2	Nichicon(equivalent)
16	1	R5	Resistor	1/8W 10kΩ 5%	MCR10EZHJ103	ROHM(equivalent)
17	1	CN1	Connector	4PIN	KCA-4R	DMC(equivalent)
18	1	CN2	Connector	5PIN	KCJ-5	DMC(equivalent)
19	1	CN3	Connector	5PIN	S5B-EH	JST(equivalent)
20	1	CN4	Connector	5PIN	S5B-EH	JST(equivalent)
21	1	CN5	Connector	8PIN	S8B-EH	JST(equivalent)
22	1	R15	Resistor	1/2W 10Ω 5%	MCR50JZHJ100	ROHM(equivalent)
23	1	R16	Resistor	1/8W 4.7k 5%	MCR10EZHJ472	ROHM(equivalent)
24	4	D6,D7,D8,D9	Diode		1SS355	ROHM(equivalent)
25	4	D10,D11,D12,D13	Diode		1SS355	ROHM(equivalent)
26	1	C9	Condenser	0.1μF 10%	GRM40B104Z50PT	Murata(equivalent)
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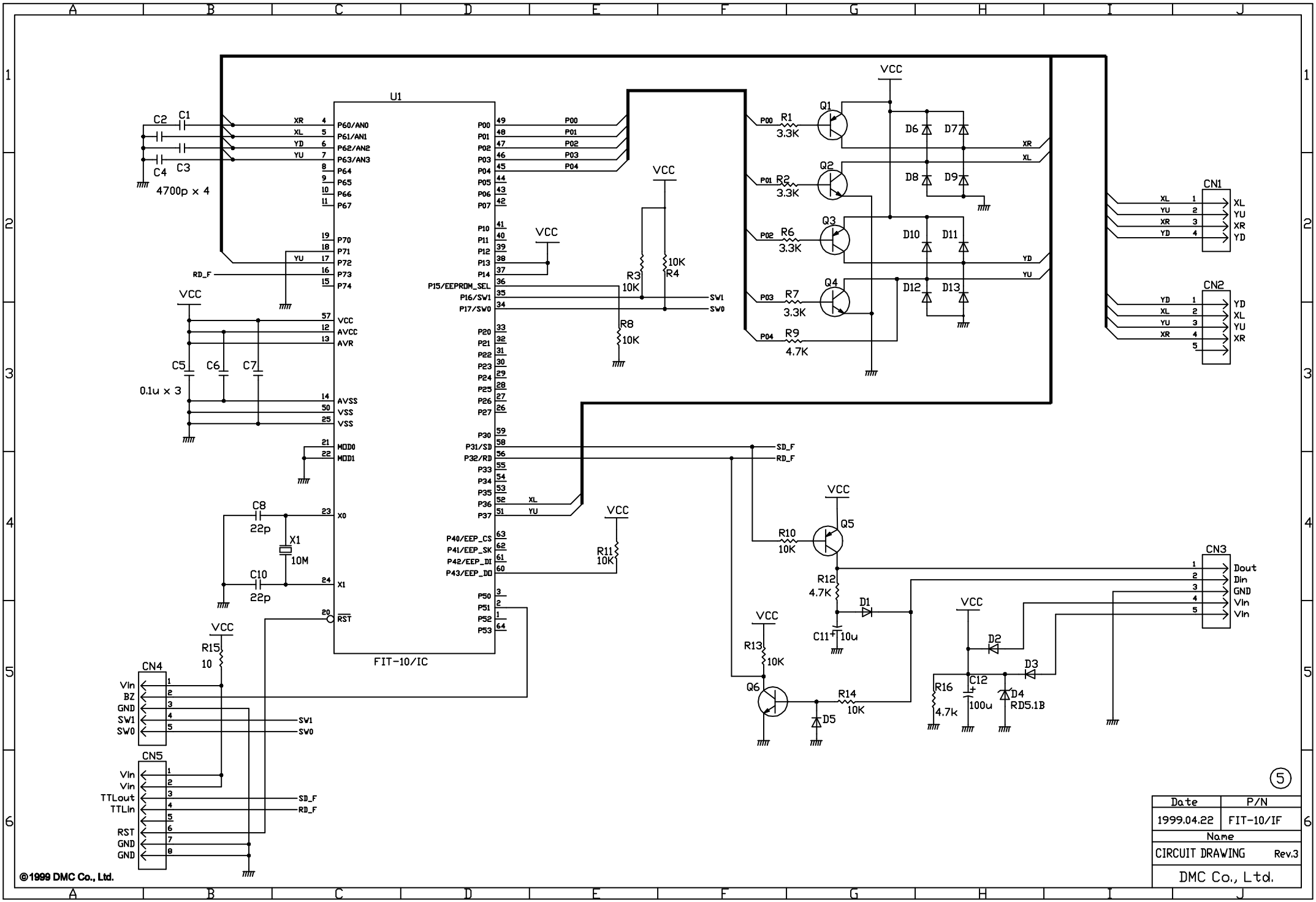
U1
FIT-10/IC
C1
C2
C3
C4
4700p x 4
C5
C6
C7
0.1u x 3
C8
22p
C10
22p
X1
10M
R15
10
R1
3.3K
R2
3.3K
R6
3.3K
R7
3.3K
R9
4.7K
R3
10K
R4
10K
R8
10K
R11
10K
R10
10K
R12
4.7K
R13
10K
R14
10K
R16
4.7k
C11
10u
C12
100u
Q1
Q2
Q3
Q4
Q5
Q6
D1
D2
D3
D4
RD5.1B
D5
D6
D7
D8
D9
D10
D11
D12
D13
VCC
CN1
CN2
CN3
CN4
CN5
XL
YU
XR
YD
SW1
SW0
SD_F
RD_F
Dout
Din
GND
Vin
BZ
TTLout
TTLin
RST
5
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P/N
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CIRCUIT DRAWING
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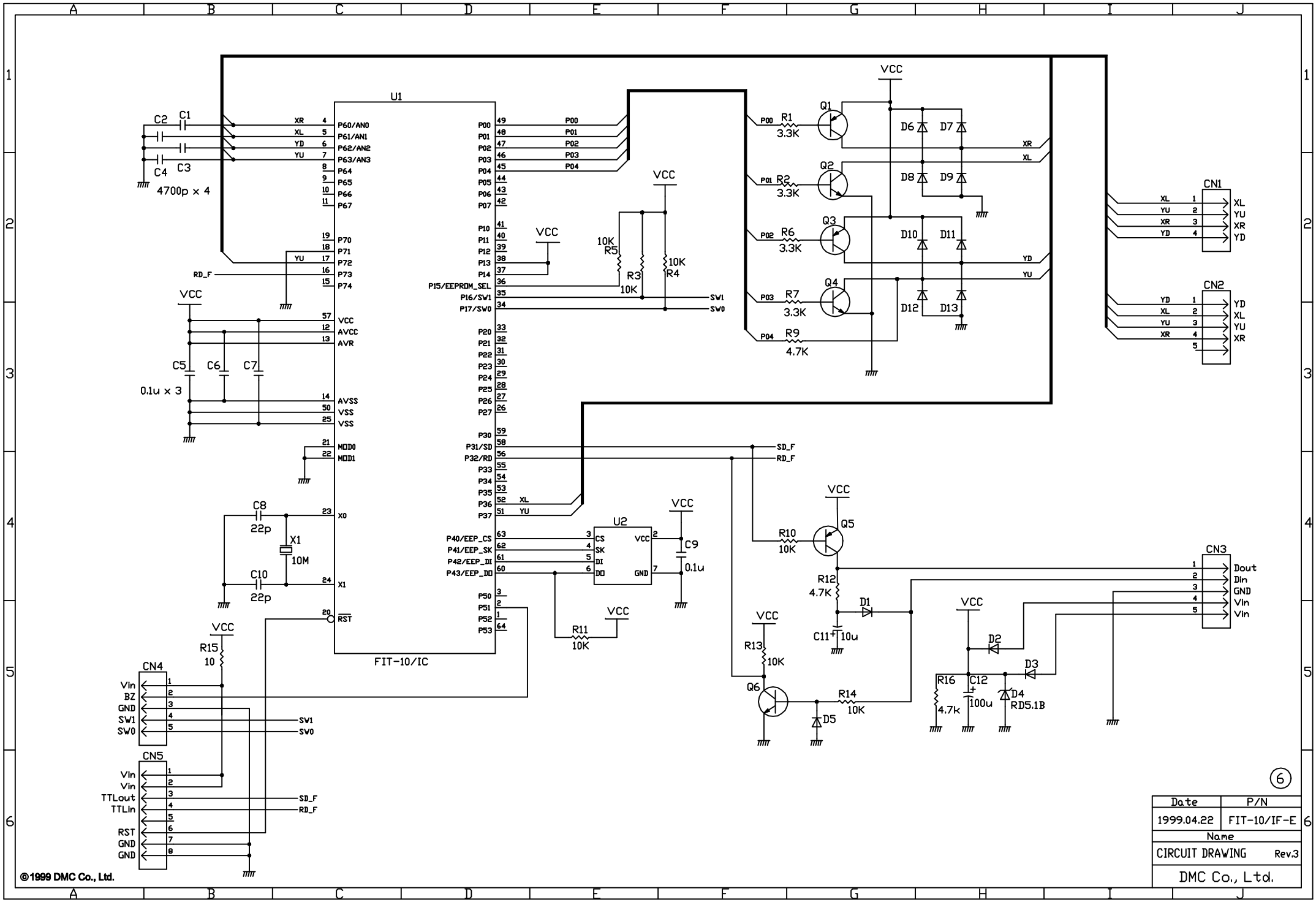
U1
FIT-10/IC
U2
VCC
C1
C2
C3
C4
4700p x 4
C5
C6
C7
0.1u x 3
C8
22p
C10
22p
X1
10M
C9
0.1u
C11
10u
R1
R2
R3
R4
R5
R6
R7
R9
R10
R11
R12
R13
R14
R15
R16
3.3K
10K
4.7K
10
100u
Q1
Q2
Q3
Q4
Q5
Q6
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
RD5.1B
CN1
CN2
CN3
CN4
CN5
XL
YU
XR
YD
SW1
SW0
SD_F
RD_F
Dout
Din
GND
Vin
BZ
TTLout
TTLin
RST
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6
Date
P/N
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CIRCUIT DRAWING
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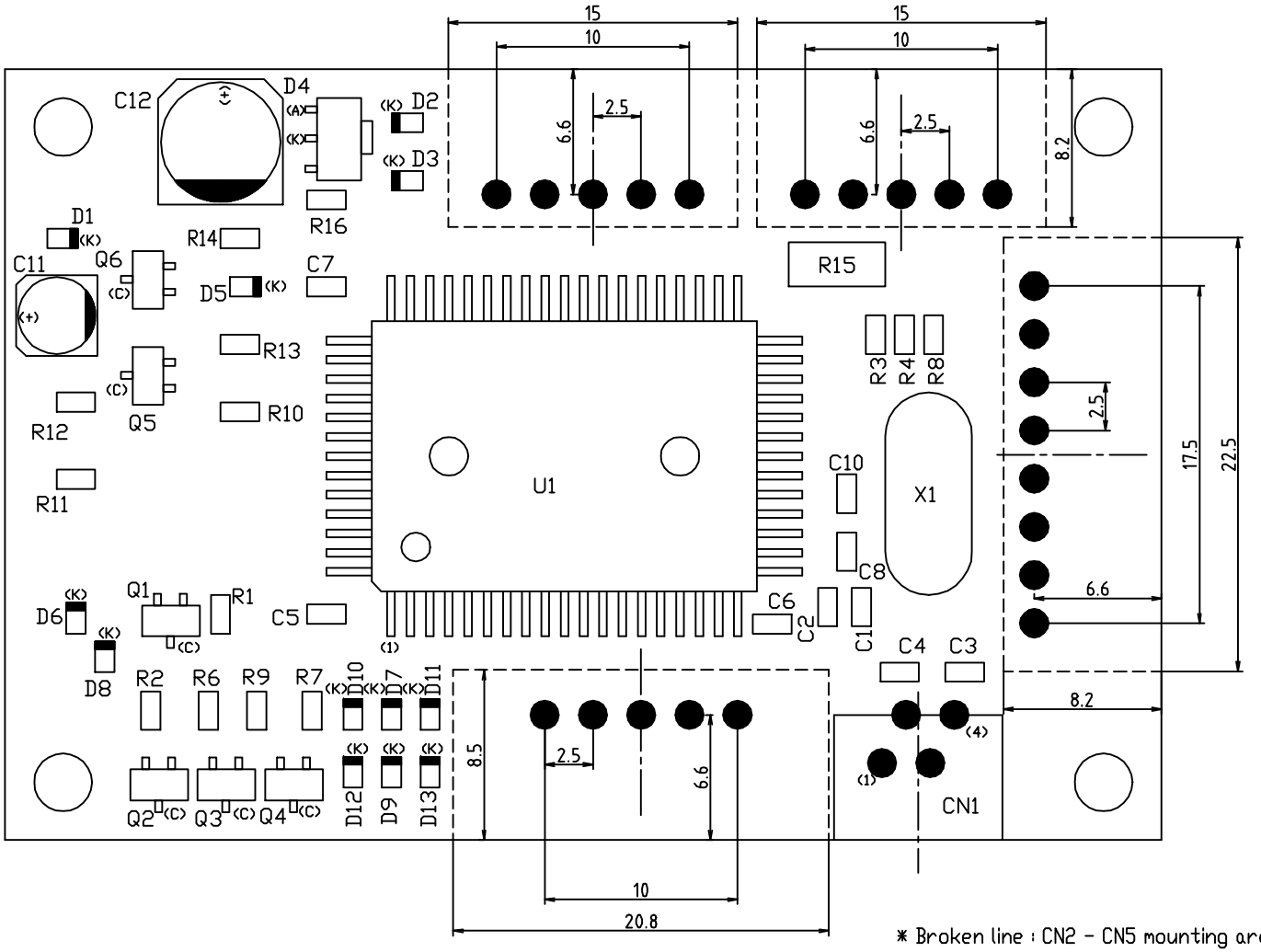

* Broken line : CN2 - CN5 mounting area

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Date	P/N
1999.06.01	FIT-10/IF
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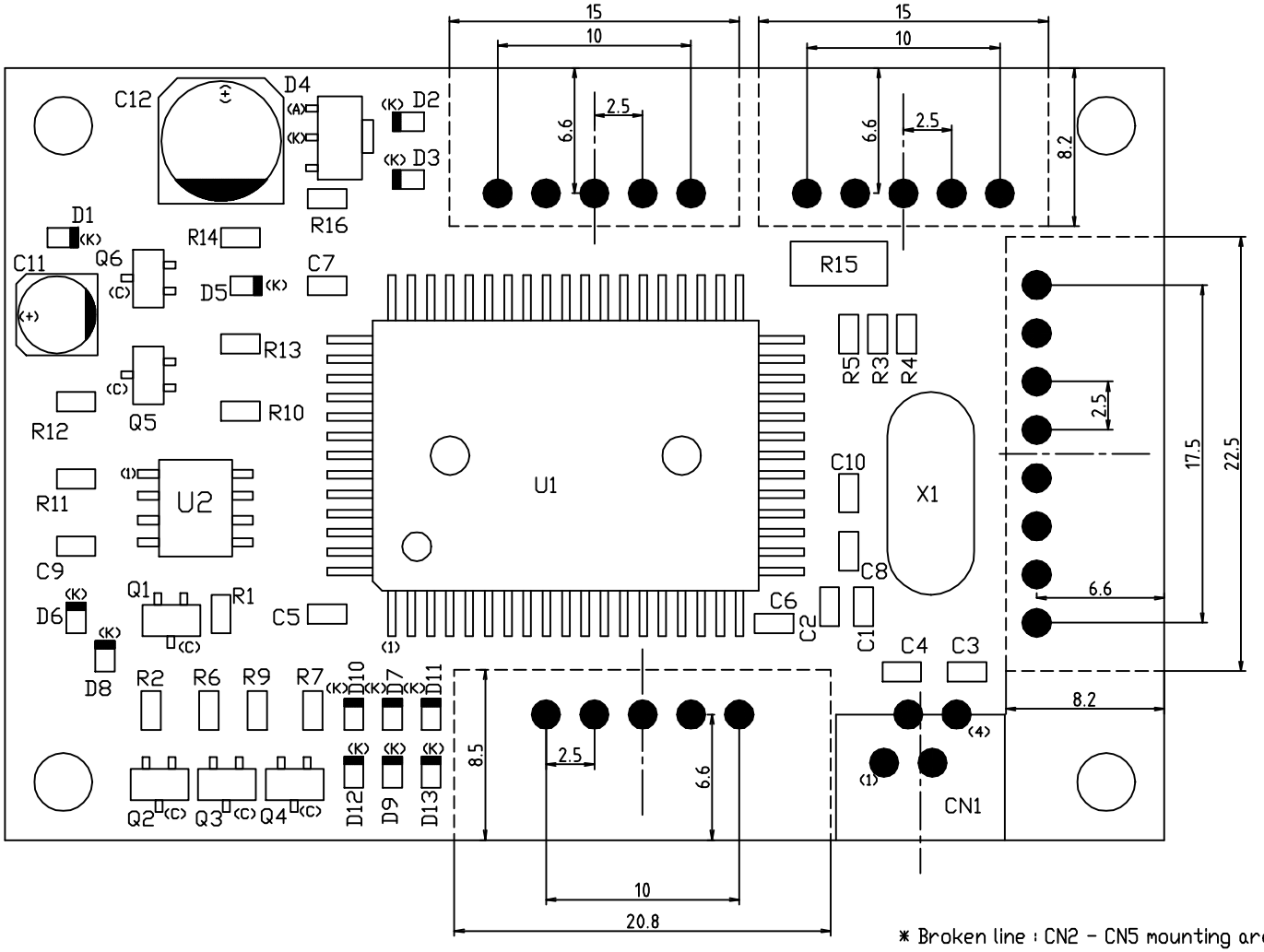

Date	P/N
1999.06.01	FIT-10/IF-E
Name	
PART MAPPING & CONNECTOR MOUNTING DIMENSIONS Rev.3	
DMC Co., Ltd.	

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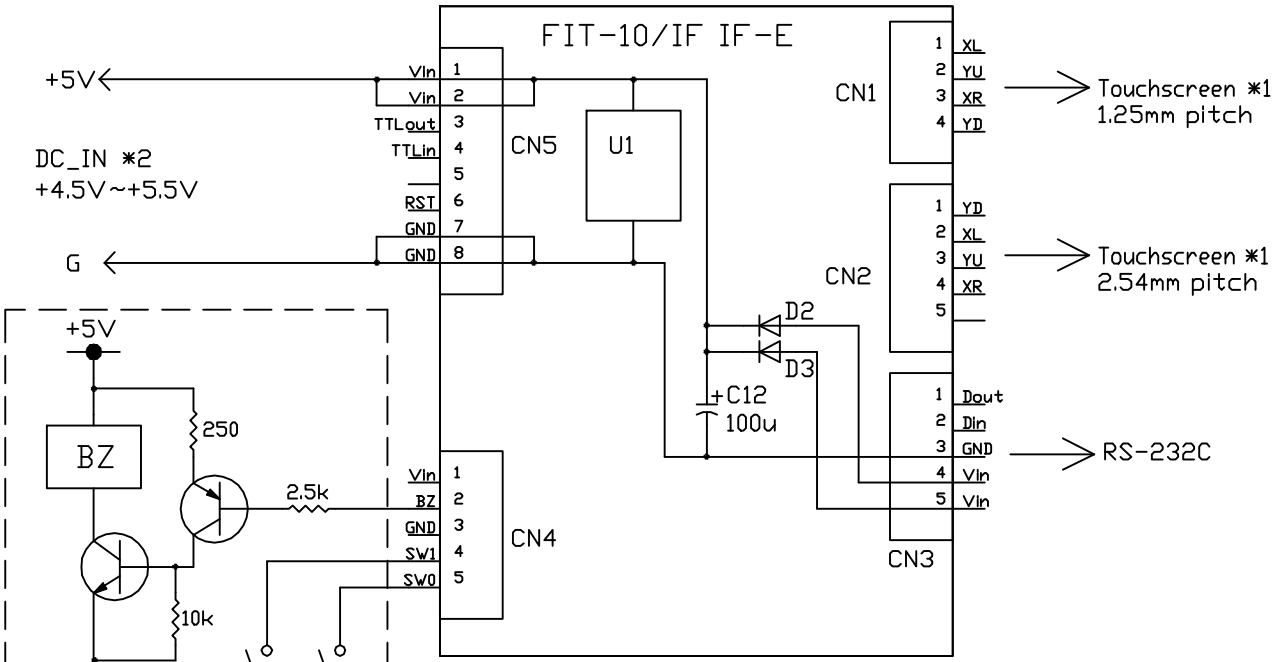
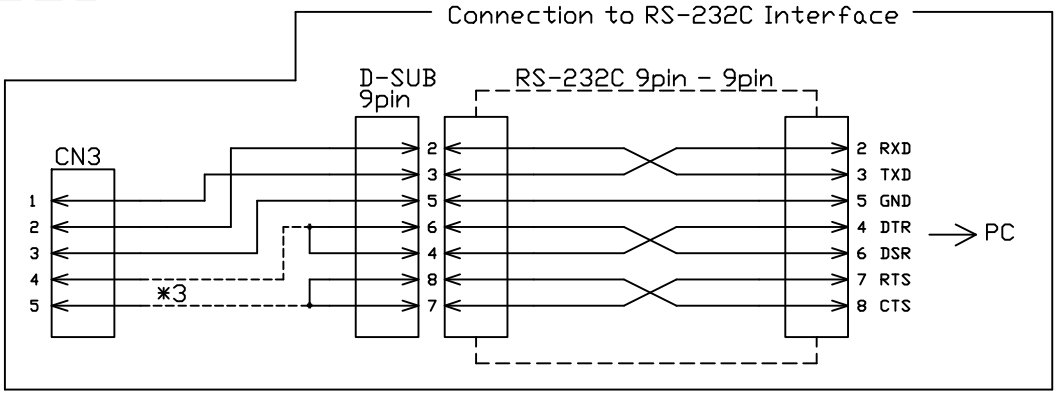
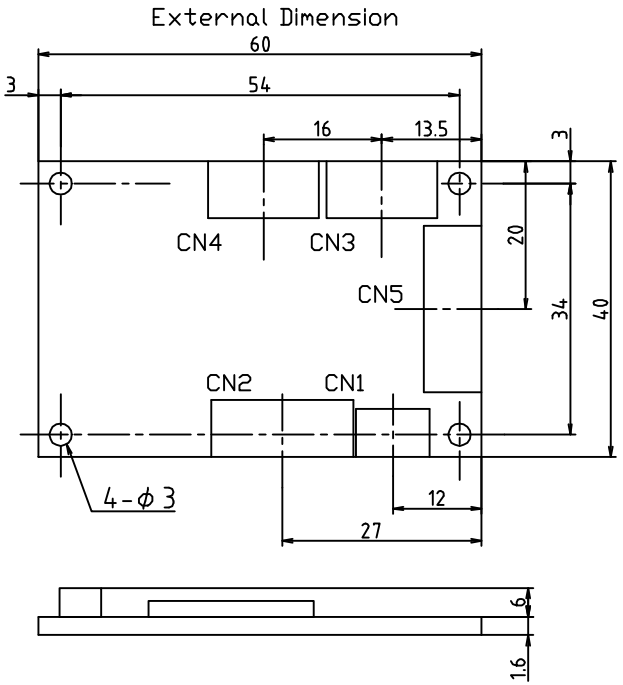


*1 CN1 or CN2 (Exclusive)
*2 Not required if power is supplied from RS-232C
*3 4 , 5 not required if power is supplied from CN5

Example of external options





Connector

Conn. No	P/N	Supplier	Remarks
CN1	KCA-4A	DMC	mounted
CN2	KCJ-5A	DMC (or equivalent)	blank
CN3	S5B-EH	JST (or equivalent)	blank
CN4	S5B-EH	JST (or equivalent)	blank
CN5	S8B-EH	JST (or equivalent)	blank

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Date	P/N
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EXTERNAL PERIPHERAL/ EXTERNAL DIMENSIONS	Rev.3
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